Thesis Project Portfolio

Optimizing Current Delivery Methods of a Male Nonhormonal Contraceptive in the Form of a Hydrogel

(Technical Report)

Gender Inequality in Reproductive Health and the Prolonged Development of Male Contraception

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Introduction

Approximately half of all pregnancies globally are unplanned. Following the overturning of Roe v. Wade, the discussion regarding inequality in the contraceptive realm has arose to the forefront of the healthcare industry. Though there are numerous long-acting hormonal and nonhormonal contraceptive methods available for women, the only long-acting form of male contraception is sterilization. Contraline is a local startup based in Charlottesville that is working to develop a novel nonhormonal male contraceptive implant. This implant is injected into the vas deferens to occlude sperm flow. My technical capstone project is focused on working with Contraline to develop an in vitro model of the vas deferens that accurately emulates in vivo delivery of Contraline's novel contraceptive implant, and using the model to develop a device to identify a more precise delivery method during cannulation. My STS research focused primarily on the gender inequality surrounding the world of reproductive health.

Project Summaries

My STS research paper investigated the societal impacts of the lack of gender inequality in the contraceptive industry using the Virtue Ethics framework. In this paper, I highlighted both the history of the development of contraceptives, and the reasoning behind the lack of male contraceptive methods on the market. Furthermore, I discussed the unresolved ethics regarding the clinical studies that were conducted to pass the first birth control pill through FDA approval. From my research, I concluded the lack of male contraceptive options is not caused by societal demand, rather it can be attributed to the monthly cycle women follow, as the female body naturally releases progesterone to restrict ovulation, therefore creating means for contraception. Spermatogenesis is constantly occurring in males, therefore, tampering with hormonal levels has

had some severe physiological impacts. My research outlines the new wave of contraceptive research as many companies are currently developing potential methods of contraception.

The goal of my technical project was to develop a model of the vas deferens that emulated in vivo conditions. Due to the lack of research available on the mechanical properties of the vas deferens, my team decided to derive the Young's modulus ourselves. After dissecting numerous canine samples, we identified that the average Young's modulus of the canine vas deferens is 16.67 N/mm^2. As the average soft tissue has a Young's modulus between 1-4 N/mm^2, our proposed model only had a Young's modulus of approximately 2 N/mm^2. We developed a device that holds the vas deferens during the cannulation procedure which provides physicians more mobility. Our research is significant because it is the first know study to investigate the mechanical properties since 1979.

Conclusion

As both my STS and technical research projects were intertwined in nature, this provided a valuable experience in which I was able to identify the problem of inequality in contraceptives while also working simultaneously to help produce the solution. After understanding the necessity of male contraceptives in the space of reproductive health, I became more understanding of the potential impact of my work. As the development of female contraceptive methods were muddled with unethical trials, I am more aware of the ethical implications of Contraline's work and the necessity for engineers and scientists to make design decisions that do not negatively impact users.

Finally, I would like to acknowledge the staff at Contraline, and specifically my technical advisor Tim Barry, as well as the Animal Hospital of Ivy Square for providing the canine samples.

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